

WHAT IS CLAIMED IS:

1 1. A microfluidic device comprising:
2 a flow channel;
3 a pump operatively interconnected to said flow channel for moving a fluid
4 in said flow channel; and
5 a damper operatively interconnected to said flow channel for reducing the
6 fluid oscillation in said flow channel.

1 2. The microfluidic device of claim 1, further comprising a flow
2 control valve operatively interconnected to said flow channel for closing and opening said
3 flow channel.

1 3. The microfluidic device of claim 2, further comprising a T-
2 junction.

1 4. The microfluidic device of claim 3, wherein said T-junction
2 comprises an injection pool, a waste pool and a collection pool interconnected by said
3 flow channel, and wherein flow channel further comprises said flow control valve
4 proximal to said waste pool and said flow control valve proximal to said collection pool,
5 said pump proximal to said injection pool and said damper proximal to said injection pool
6 but posterior to said pump.

1 5. The microfluidic device of claim 4 further comprising a plurality of
2 said dampers.

1 6. The microfluidic device of claim 1 wherein the damper comprises a
2 cavity separated from the flow channel by a flexible membrane, the flexible membrane
3 deflectable into the cavity to absorb energy in response to pressure oscillation within the
4 flow channel, thereby reducing an amplitude of the pressure oscillation.

1 7. The microfluidic device of claim 6 further comprising a
2 constriction in a width of the flow channel positioned downstream of the flexible
3 membrane.

1 8. The microfluidic device of claim 1 wherein the damper comprises
2 an enlarged portion of the flow channel partially filled with a fluid, the fluid compressible

3 to absorb energy in response to pressure oscillation within the flow channel, thereby
4 reducing an amplitude of the pressure oscillation.

1 9. The microfluidic device of claim 1 wherein the damper comprises
2 elastomeric material forming walls of the flow channel, the elastomeric material
3 deflectable to absorb energy in response to pressure oscillation within the flow channel,
4 thereby reducing an amplitude of the pressure oscillation.

1 10. A microfluidic sorting device comprising:
2 a first flow channel formed in a first layer of elastomer material, a first end
3 of the first flow channel in fluid communication with a collection pool and a second end
4 of the first flow channel in fluid communication with a waste pool;
5 a second flow channel formed in the first elastomer layer, a first end of the
6 second flow channel in fluid communication with an injection pool and a second end of
7 the second flow channel in fluid communication with the first flow channel at a junction;
8 a collection valve adjacent to a first side of the junction proximate to the
9 collection pool, the collection valve comprising a first recess formed in a second
10 elastomer layer overlying the first elastomer layer, the first recess separated from the first
11 flow channel by a first membrane portion of the second elastomer layer deflectable into
12 the first flow channel;
13 a waste valve adjacent to a second side of the junction proximate to the
14 waste pool, the waste valve comprising a second recess formed in the second elastomer
15 layer separated from the second flow channel by a second membrane portion of the
16 second elastomer layer deflectable into the first flow channel;
17 a pump adjacent to a third side of the junction proximate to the injection
18 pool, the pump comprising at least pressure channels formed in the second elastomer
19 layer and separated from second flow channel by third membrane portions of the second
20 elastomer layer deflectable into the second flow channel; and
21 a detection region positioned between the injection pool and the junction,
22 one of an open and closed state of the collection valve and the waste valve determined by
23 an identity of a sortable entity detected in the detection region.

1 11. The microfluidic device of claim 10 further comprising a damper
2 structure adjacent to the second flow channel between the pump and the detection region.

1 12. The microfluidic device of claim 11 wherein the damper comprises
2 a cavity formed in the second elastomer layer and separated from the second flow channel
3 by a flexible membrane, the flexible membrane deflectable into the cavity to absorb
4 energy in response to pressure oscillation within the second flow channel, thereby
5 reducing an amplitude of the pressure oscillation.

1 13. The microfluidic device of claim 12 further comprising a
2 constriction in a width of the second flow channel between the flexible membrane and the
3 junction.

1 14. The microfluidic device of claim 11 wherein the damper comprises
2 an enlarged portion of the flow channel partially filled with a fluid, the fluid compressible
3 to absorb energy in response to pressure oscillation within the flow channel, thereby
4 reducing an amplitude of the pressure oscillation.

1 15. The microfluidic device of claim 10 wherein the elastomer material
2 forming walls of the first flow channel is deflectable to absorb energy in response to
3 pressure oscillation within the flow channel, thereby reducing an amplitude of the
4 pressure oscillation.

1 16. The microfluidic device of claim 10 wherein the junction is T-
2 shaped.

1 17. The microfluidic device of claim 10 further comprising a second
2 sorter structure positioned between the waste valve and the waste pool.

1 18. A damper for a microfluidic device comprising:
2 a flow channel formed in an elastomer material; and
3 an energy absorber adjacent to the flow channel and configured to absorb
4 an energy of oscillation of a fluid positioned within the flow channel.

1 19. The damper of claim 18 wherein the energy absorber comprises a
2 flexible elastomer membrane positioned between the flow channel and a cavity, the
3 flexible membrane deflectable into the cavity to absorb the energy of oscillation in the
4 flow channel.

1 20. The damper of claim 18 wherein the energy absorber comprises a
2 fluid positioned within an enlarged portion of the flow channel, the fluid compressible to
3 absorb the energy of oscillation.

1 21. The damper of claim 18 wherein the energy absorber comprises
2 elastomer material on the side walls of the flow channel, the elastomer material
3 deflectable to absorb the energy of oscillation.

1 22. The damper of claims 19, 20, or 21 further comprising a
2 constriction in a width of the flow channel downstream of the energy absorber.

1 23. A sorting method comprising:
2 deflecting a first elastomer membrane of an elastomer block into a flow
3 channel to cause a sortable entity to flow into a detection region positioned upstream of a
4 junction in the flow channel;
5 interrogating the detection region to identify the sortable entity within the
6 detection region;
7 based upon an identity of the sortable entity, deflecting one of a second
8 membrane and a third membrane of the elastomer block into one of a first branch flow
9 channel portion and a second branch flow channel portion located downstream of the
10 junction to cause the sortable entity to flow to one of a collection pool or a waste pool.

1 24. The method of claim 23 wherein the sortable entity is flowed once
2 through the detection region.

1 25. The method of claim 23 wherein:
2 the sortable entity is initially flowed through the detection region; and then
3 a direction of flow is reversed to flow the sortable entity back into the
4 detection region.

1 26. The method of claim 23 further comprising dampening an
2 oscillation of energy within the flow channel upstream of the junction.

1 27. A method for sorting a material using a microfluidic device of
2 claim 4.

1 28. The method of claim 27 comprising using a reversible sorting
2 process.

1 29. A method for dampening pressure oscillations in a flow channel
2 comprising providing an energy absorber adjacent to the flow channel, such that the
3 energy absorber experiences a change in response the pressure oscillations.

1 30. The method of claim 29 wherein the energy absorber comprises a
2 flexible membrane that deflects into a cavity in response to the pressure oscillations.

1 31. The method of claim 29 wherein the energy absorber comprises a
2 fluid pocket that experiences compression in response to the pressure oscillations.

1 32. The method of claim 29 wherein the energy absorber comprises an
2 elastomeric flow channel sidewall that experiences deformation in response to the
3 pressure oscillations.

1 33. The method of claim 29 further comprising constricting a width of
2 the flow channel downstream of the energy absorber.